Project Specification

Bike Demand and Distribution Optimization (BDaDO)

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Github: https://github.com/phillyq22/Senior-Project

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**Project Summary:**

This project seeks to help create a self sustaining bike share system by developing a machine learning algorithm to determine supply and demand for bikes at pick up and drop off points for bike sharing services. The machine learning algorithm to be developed will be trained utilizing regression techniques in order to predict the number of bikes needed at a bike station in the near future. The prediction will come in the form of a single value indicating the number of bikes needed at a bike station. Multiple algorithms will be implemented in order to compare the results of each. The best of the algorithms will be evaluated based on their accuracy and precision, in addition to several other metrics. By knowing the number of bikes needed, an algorithm will then suggest nearby pick up points that exceed their demand, as well as drop off points near the destination that which are not meeting their projected demand, given that these are applicable. Data is continuously being collected by companies on multiple bike stations and can be pulled utilizing API calls. Data will be collected as it becomes accessible through API calls in order to train new algorithms and test the accuracy of existing models.

**Project Goals:**

The main goals of this project are to:

1. Develop a Bike Demand Prediction Algorithm (BDPA) capable of predicting the number of bikes needed at a certain location and time.
   1. Collect available data on bike sharing from various sources.
   2. Transform data into various representations that could be advantageous to a model’s design.
   3. Determine valuable metrics for model comparisons.
   4. Develop multiple models and compare effectiveness.
   5. Collect current data on bike sharing through API calls to company data repositories.
   6. Train and test new and old models on current data.
2. Develop an algorithm suggesting drop off and pickup points to meet the demand for bikes predicted by the BDPA.
   1. Develop algorithm to find shortest path between two sets of longitude and latitude coordinates.
   2. Suggest multiple pick up locations based on the projected bike demand of bike stations near the user.
   3. Suggest multiple drop off locations based on the projected bike demand of bike stations near the user’s destination.
3. With the pick up and drop off suggestion algorithms, increase the overall availability of bikes to meet the projected demands of each bike station.
4. The pick up and drop off suggestion algorithm shall reduce the need of hiring staff to relocate the bikes.

**Product Features:**

1. Machine learning algorithm which predicts the number of bikes needed at a certain location.
2. Algorithms suggesting drop off and pick up locations which make a suggestion based on current longitude and latitude coordinates of a user, as well as the projected demand of each bike share location

**Limitations:**

The project could be met with many limitations, which may include:

1. BDPA may predict incorrectly on current data due to variations in trends over time.
2. More data is always necessary to increase the accuracy of the BDPA. New data will be collected, but this may not be enough to accurately represent the current bike sharing distributions.
3. New factors changing the demand for bikes in certain locations will not be accounted for in the BDPA, being that it is trained with old data.
4. No way to guarantee that users follow the suggestions of the algorithm to keep the bike sharing system self-sustaining.
5. Accuracy can vary depending on time of year and the environment in which the product is being used.

**Stretch Goals:**

Should the opportunity present itself, we would like to be able to include the following:

1. A GUI for users to request bikes at pick up stations and choose a destination drop off station to receive suggestions for pick up and drop off.
2. An android app that will display the GUI.
   1. Interpret user’s GPS location to suggest best pick up and drop off location.
   2. Track user’s GPS location and bike usage to further train the BDPA with newer data.
3. Fine tune BDPA to achieve an accuracy of over 90%.
4. Implement different BDPAs in different locations to determine the effect of the location on the algorithm.
5. Establish a model that performs online learning. As new bike share data is pulled from the API, the model will learn from this new trend data and assist in making further predictions.